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(54) **IMAGE DISPLAY APPARATUS AND METHOD FOR OPERATING THE SAME**

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H04N 21/422	(2011.01)
G06F 3/0481	(2013.01)
G06F 3/0354	(2013.01)
G06F 3/0484	(2013.01)
G06F 3/038	(2013.01)
G06F 3/0482	(2013.01)
G06F 3/0346	(2013.01)

(52) **U.S. Cl.**

CPC ***H04N 21/42222*** (2013.01); ***G06F 3/038*** (2013.01); ***G06F 3/0346*** (2013.01); ***G06F 3/03542*** (2013.01); ***G06F 3/0482*** (2013.01); ***G06F 3/04812*** (2013.01); ***G06F 3/04817*** (2013.01); ***G06F 3/04842*** (2013.01); *G06F 2203/0384* (2013.01)

(58) **Field of Classification Search**

CPC . G06F 3/0386; G06F 3/0482; G06F 3/04842; G06F 3/0481; G06F 3/03542; G06F 3/04812; G06F 2203/0384; G06F 3/04817

USPC 345/157, 179, 183; 715/740, 856; 348/734

See application file for complete search history.

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Primary Examiner — Michael J Eurice

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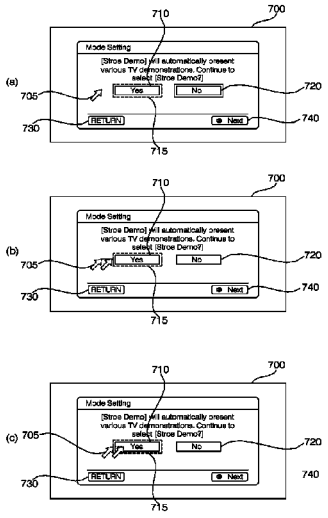
(57) **ABSTRACT**

According to an embodiment of the present invention, a method for operating an image display device that receives a signal from a pointing device includes receiving, from the pointing device, a pointing signal to display a pointer on a display of the image display device, and a selection signal, wherein the selection signal includes information regarding a command to perform an operation on the image display device, displaying, on the display, the pointer corresponding to the pointing signal, determining whether the pointer is displayed on a most frequently displayed region during an input standby time associated with the selection signal, and performing an operation associated the most frequently displayed region when the pointer is displayed on the most frequently displayed region during the input standby time.

4 Claims, 11 Drawing Sheets



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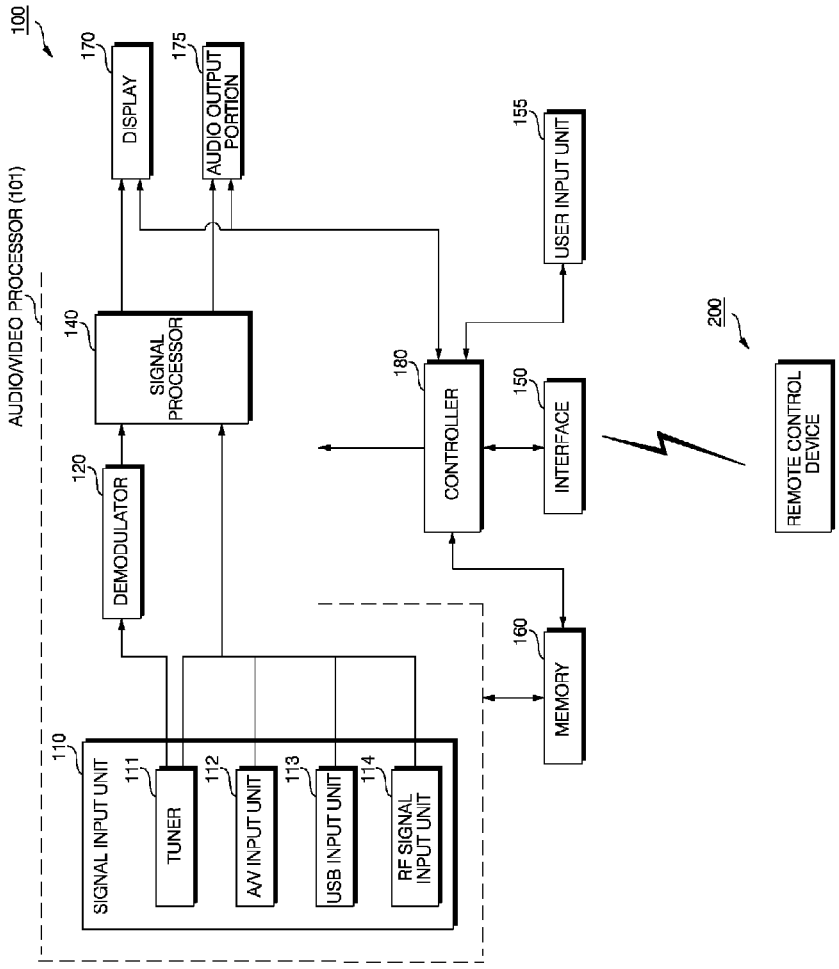

100
AUDIO/VIDEO PROCESSOR (101)
170
DISPLAY
175
AUDIO OUTPUT PORTION
155
USER INPUT UNIT
140
SIGNAL PROCESSOR
180
CONTROLLER
150
INTERFACE
200
REMOTE CONTROL DEVICE
120
DEMODULATOR
160
MEMORY
110
SIGNAL INPUT UNIT
111
TUNER
112
A/V INPUT UNIT
113
USB INPUT UNIT
114
RF SIGNAL INPUT UNIT

FIG. 1

FIG. 2A

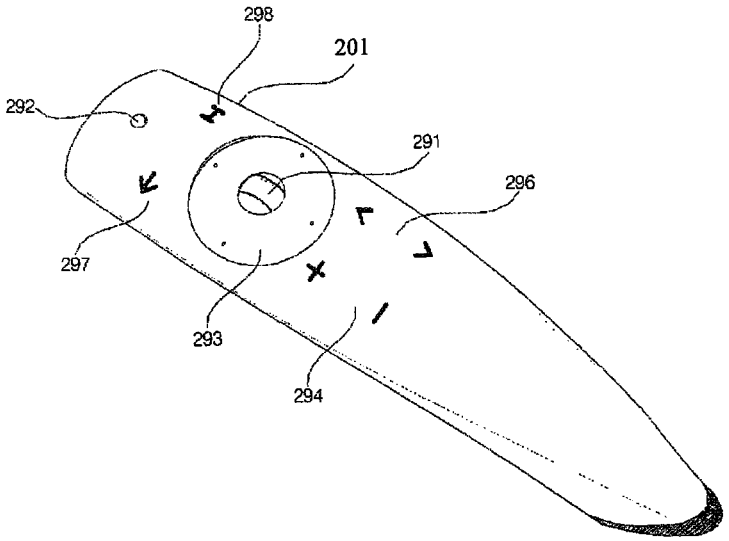


FIG. 2B

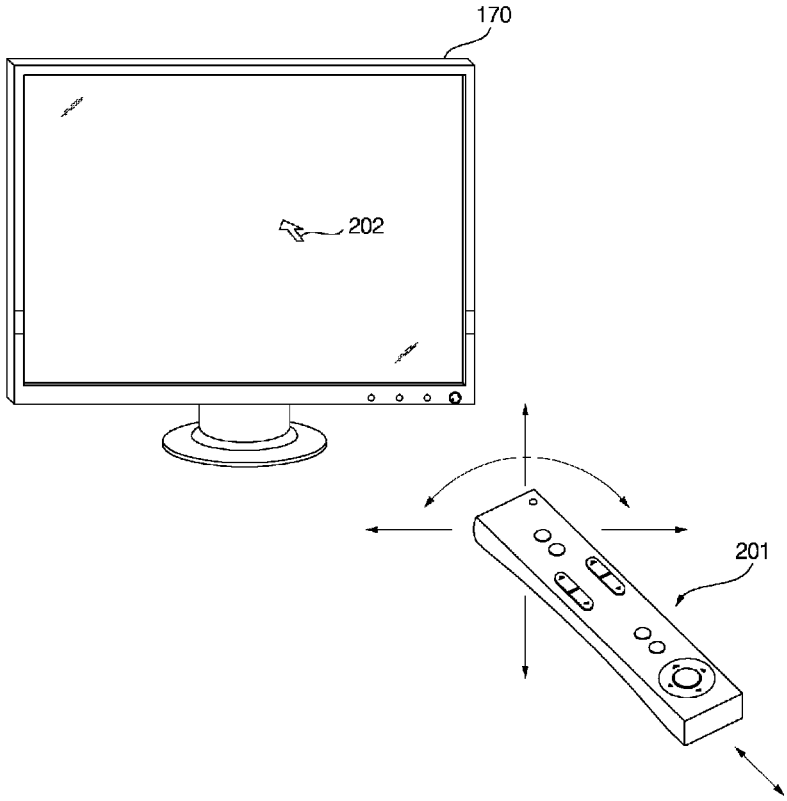


FIG. 2C

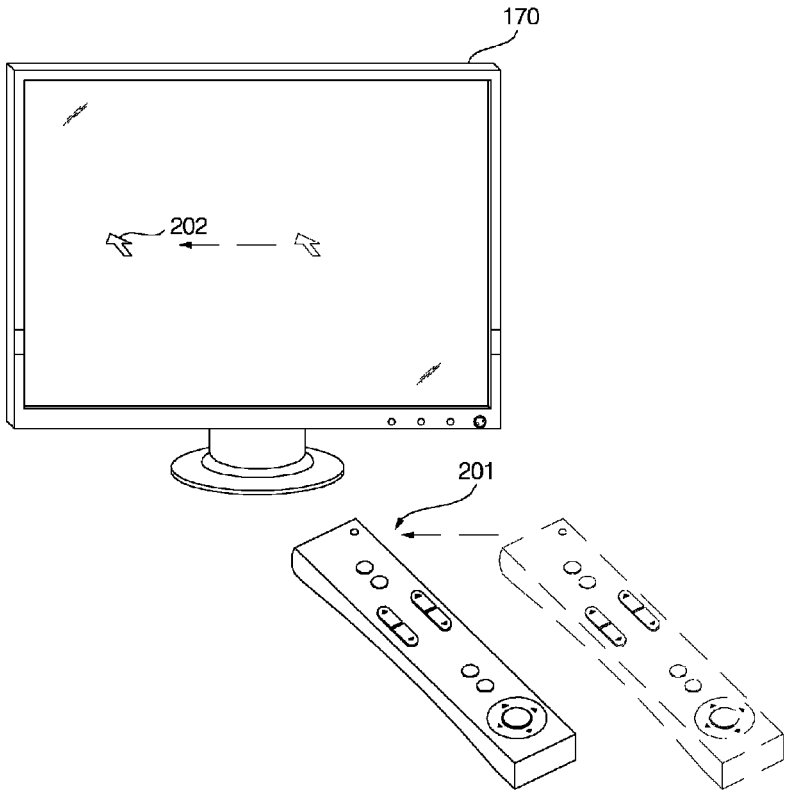


FIG. 3

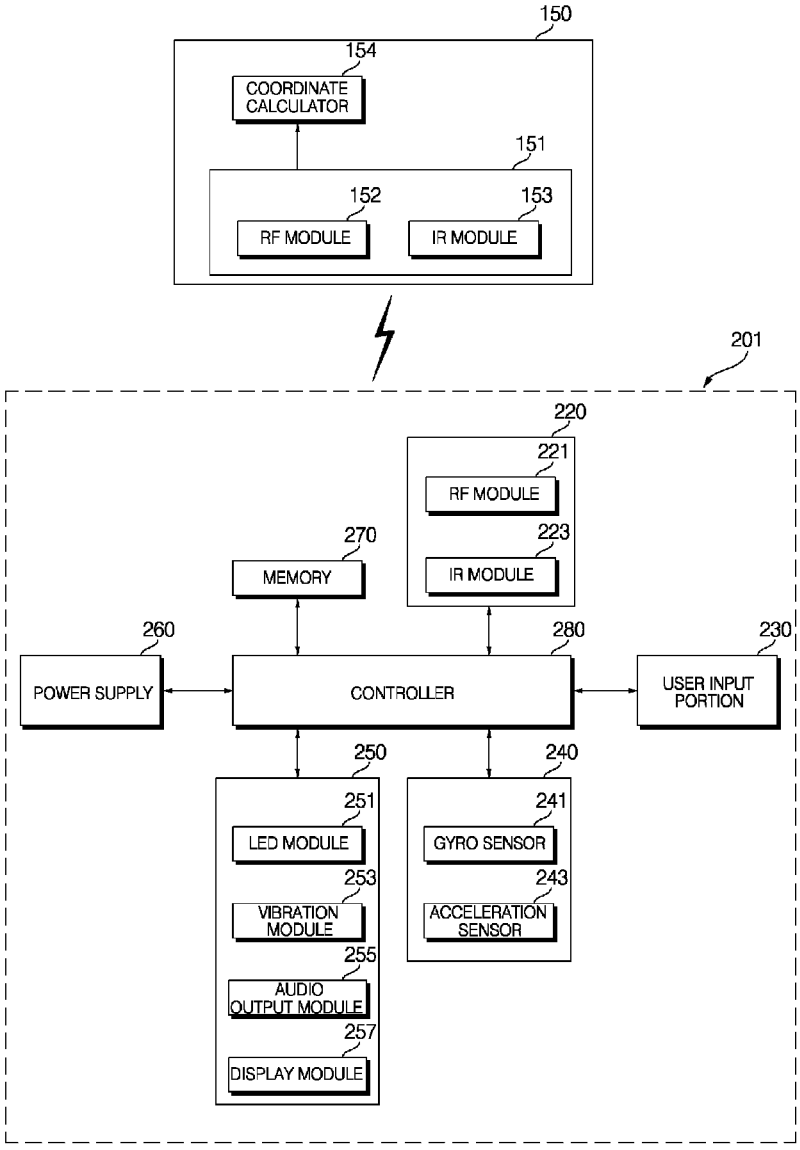

150
154
COORDINATE CALCULATOR
151
152
RF MODULE
153
IR MODULE
201
220
221
RF MODULE
223
IR MODULE
270
MEMORY
260
POWER SUPPLY
280
CONTROLLER
230
USER INPUT PORTION
250
251
LED MODULE
253
VIBRATION MODULE
255
AUDIO OUTPUT MODULE
257
DISPLAY MODULE
240
241
GYRO SENSOR
243
ACCELERATION SENSOR

FIG. 4

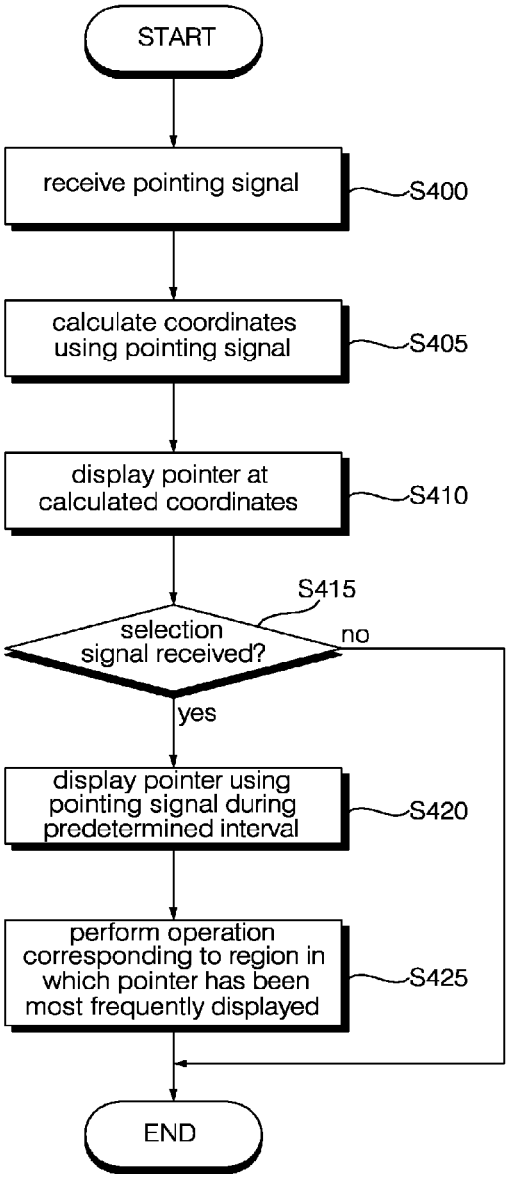
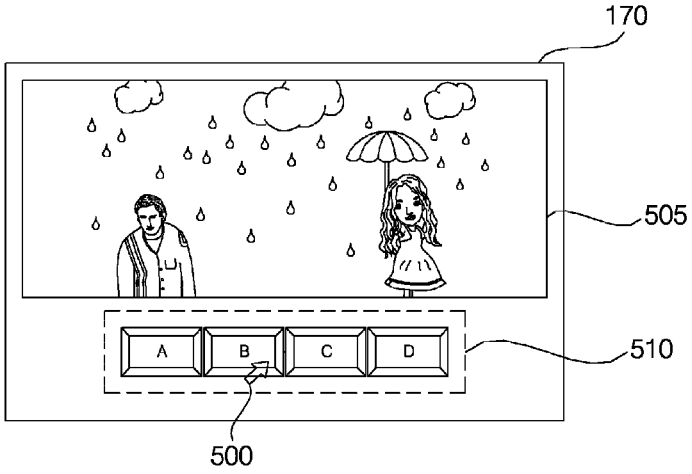
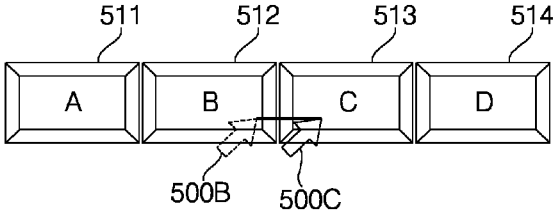

START
receive pointing signal
S400
calculate coordinates using pointing signal
S405
display pointer at calculated coordinates
S410
S415
selection signal received?
no
yes
display pointer using pointing signal during predetermined interval
S420
perform operation corresponding to region in which pointer has been most frequently displayed
S425
END

FIG. 5



(a)



(b)

FIG. 6

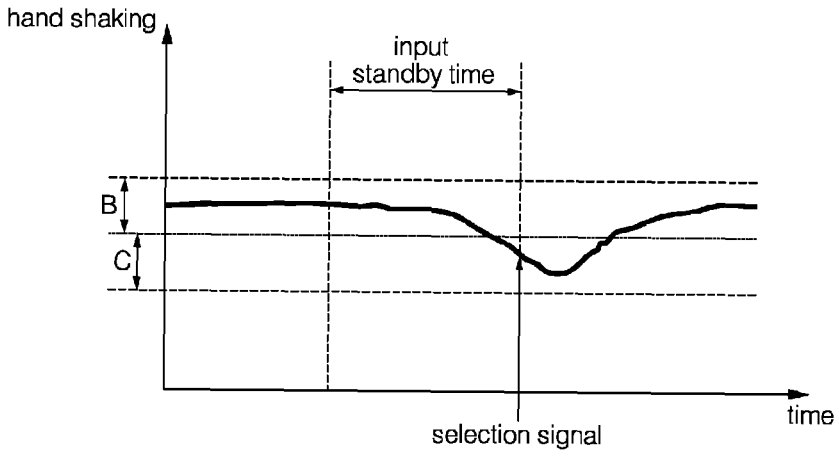


FIG. 7

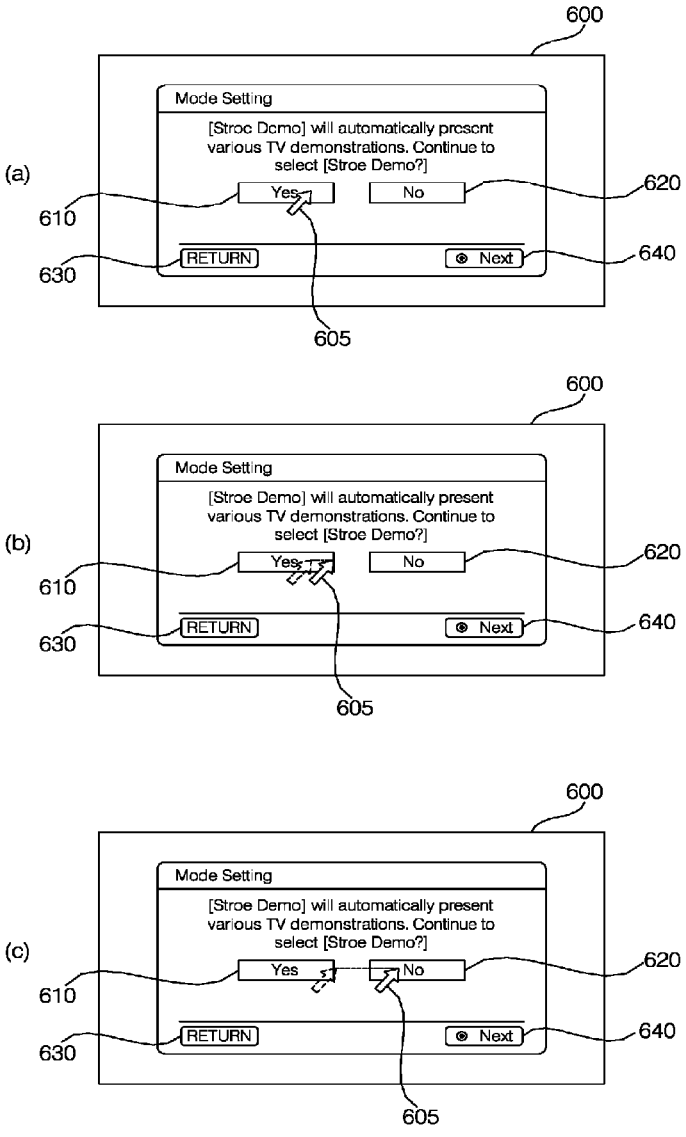

600
Mode Setting
[Stroc Demo] will automatically present various TV demonstrations. Continue to select [Stroe Demo?]
Yes
No
RETURN
Next
(a)
610
620
630
640
605
600
Mode Setting
[Stroe Demo] will automatically present various TV demonstrations. Continue to select [Stroe Demo?]
Yes
No
RETURN
Next
(b)
610
620
630
640
605
600
Mode Setting
[Stroe Demo] will automatically present various TV demonstrations. Continue to select [Stroe Demo?]
Yes
No
RETURN
Next
(c)
610
620
630
640
605

FIG. 8

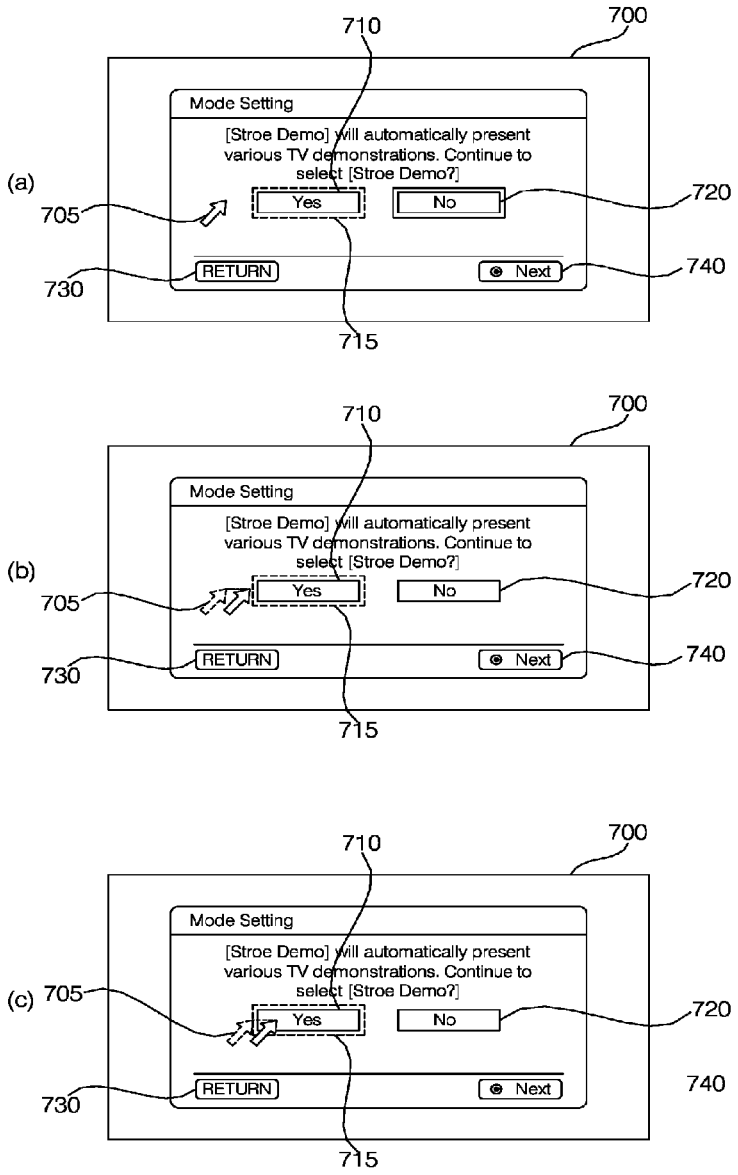

(a)
(b)
(c)
700
710
715
720
730
740
705
Mode Setting
[Stroe Demo] will automatically present various TV demonstrations. Continue to select [Stroe Demo?]
Yes
No
RETURN
Next

FIG. 9

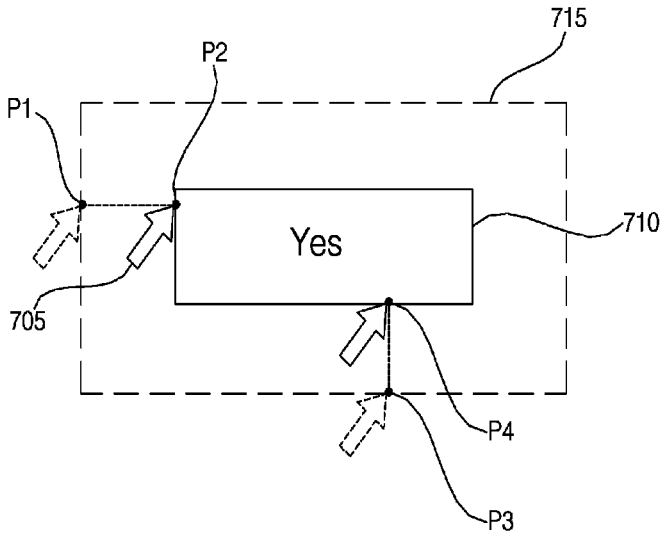


IMAGE DISPLAY APPARATUS AND METHOD FOR OPERATING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

This application claims benefit of priority of U.S. Provisional Application No. 61/437,663 filed on Jan. 30, 2011 in the USPTO, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an image display device and a method for operating the same, and more particularly to an image display device, which can perform an operation corresponding to user intention using a pointing device, and a method for operating the same.

2. Description of the Related Art

An image display device is an apparatus that can display a broadcast signal, a user input signal, a moving image signal, a signal transmitted from a web server, and the like on a display. Specifically, the image display device displays a broadcast selected by the user from among broadcasts transmitted from broadcasting stations. Currently, broadcasting is transitioning from analog broadcasting to digital broadcasting throughout the world.

Digital broadcasting transmits digital audio and video signals. Digital broadcasting offers many advantages over analog broadcasting. The advantages include robustness against noise, less data loss, and easier error correction. Also, the digital broadcasting provides clearer and high-definition images. In addition, digital broadcasting allows interactive viewer services which analog broadcasting does not provide.

A remote control device such as a remote controller separated from the image display device is used to operate the image display device. There has been a need to add various functions to the remote control device as the image display device have become to perform various operations. Various methods for increasing user convenience have been studied.

SUMMARY OF THE INVENTION

Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide an image display device, which reduces problems caused by use of a pointing device while a signal is input to perform an operation and allows an operation to be performed as intended by a user, and a method for operating the same.

In accordance with an aspect of the present invention, the above and other objects can be accomplished by the provision of a method for operating an image display device, the method including receiving a pointing signal from a pointing device, displaying a pointer corresponding to the pointing signal, and performing, when a selection signal is received from the pointing device, an operation corresponding to a region in which a pointer corresponding to a pointing signal received during an input standby time has been most frequently displayed during the input standby time.

In accordance with another aspect of the present invention, there is provided an image display device including an interface for receiving a pointing signal and a selection signal from a pointing device, a display for displaying a pointer corresponding to the pointing signal, and a controller for performing, when a selection signal is received from the pointing device, an operation corresponding to a region in which a pointer corresponding to a pointing signal received during an input standby time has been most frequently displayed during the input standby time.

According to an embodiment of the present invention, a method for operating an image display device that receives a signal from a pointing device includes receiving, from the pointing device, a pointing signal to display a pointer on a display of the image display device, and a selection signal, wherein the selection signal includes information regarding a command to perform an operation on the image display device, displaying, on the display, the pointer corresponding to the pointing signal, determining whether the pointer is displayed on a most frequently displayed region during an input standby time associated with the selection signal, and performing an operation associated the most frequently displayed region when the pointer is displayed on the most frequently displayed region during the input standby time.

According to an embodiment of the present invention, a method for operating an image display device includes displaying a pointer within a first object displayed on a display of the image display device, receiving a movement signal from a remote control device to move the pointer, and automatically moving, by the controller, the pointer to inside of a second object adjacent to the first object when the pointer has moved outside the first object according to the movement signal.

According to an embodiment of the present invention, a method for operating an image display device includes displaying a pointer outside a plurality of objects displayed on a display of the image display device, receiving, from a remote control device, a movement signal to move the pointer on the display, the movement signal including information regarding a location of the pointer, moving the pointer on the display according to the movement signal, and automatically moving, by the controller, the pointer onto a particular object among the plurality of objects when the pointer is moved to a predetermined outer area outside of the particular object according to the movement signal.

According to the present invention, it is possible to correctly perform an operation intended by the user when the image display device is controlled using the pointing device.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a block diagram showing the internal configuration of an image display device according to an embodiment of the present invention;

FIGS. **2**A to **2**C are perspective views of an image display device and a pointing device that can input a command to the image display device according to an embodiment of the present invention;

FIG. **3** is a block diagram of the pointing device **201** and the interface **150** of the image display device **100** according to an embodiment of the present invention;

FIG. **4** is a flow chart illustrating a method for operating an image display device according to an embodiment of the present invention;

FIG. **5** illustrates a method for operating an image display device according to an embodiment of the present invention together with a screen displayed on a display;

FIG. **6** illustrates change of a pointing signal according to an embodiment of the present invention; and

FIGS. **7** to **9** illustrate a method for operating an image display device according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Various embodiments of the present invention will be described with reference to the attached drawings.

FIG. **1** is a block diagram showing the internal configuration of an image display device according to an embodiment of the present invention.

Referring to FIG. **1**, an image display apparatus **100** includes an audio/video (A/V) processor **101**, an interface **150**, a memory **160**, a display **170**, an audio output portion **175** and a controller **180**.

The A/V processor **101** processes an input audio or video signal so that an image or voice may be output to the display **170** or the audio output portion **175** of the image display device **100**. For the video or audio processing, the A/V processor **101** may include a signal input unit **110**, a demodulator **120**, and a signal processor **140**. The signal input unit **110** may include one or more tuners **111**, an A/V input unit/module **112**, a Universal Serial Bus (USB) input unit/module **113**, and a radio frequency (RF) signal input unit/module **114**.

The tuners **111** selects a Radio Frequency (RF) broadcast signal corresponding to a channel selected by a user from among a plurality of RF broadcast signals received through an antenna and downconverts the selected RF broadcast signal into an Intermediate Frequency (IF) signal or a baseband audio or video signal. For example, if the selected RF broadcast signal is a digital broadcast signal, the tuner **111** downconverts the RF broadcast signal to a Digital IF (DIF) signal. If the selected RF broadcast signal is an analog broadcast signal, the tuner **111** downconverts the RF broadcast signal to an analog baseband video or audio signal (Composite Video Banking Sync (CVBS)/Sound Intermediate Frequency (SIF)). That is, the tuner **111** is capable of processing a digital or analog broadcast signal. The analog baseband video or audio signal (CVBS/SIF) output from the tuner **111** may be provided directly to the signal processor **140**. The tuner **111** may receive a single-carrier RF broadcast signal based on Advanced Television System Committee (ATSC) or a multi-carrier RF broadcast signal based on Digital Video Broadcasting (DVB).

In accordance with another embodiment of the present invention, the image display device **100** may include at least two tuners. If the image display device **100** includes at least two tuners, a second tuner also selects an RF broadcast signal of a user-selected channel from among RF broadcast signals received through the antenna and downconverts the selected RF broadcast signal to an IF signal or a baseband video or audio signal. Also, the second tuner may sequentially select RF signals of all broadcast channels that have been stored by a channel memory function and downconvert the selected RF signals to IF signals or baseband video or audio signals. Here, the second tuner may perform downconversion of the RF signals of all broadcast channels periodically.

Hence, the image display device **100** may provide video signals of a plurality of channels downconverted by the second tuner as thumbnail images, while displaying the video of a broadcast signal downconverted by the first tuner. In this case, the first tuner may downconvert a user-selected main RF broadcast signal to an IF signal or a baseband video or audio signal, and the second tuner may sequentially/periodically select all RF broadcast signals except for the main RF broadcast signal and downconvert the selected RF broadcast signals to IF signals or baseband video or audio signals.

The demodulator **120** demodulates the DIF signal received from the tuner **111**. For example, if the DIF signal output from the tuner **111** is an ATSC signal, the demodulator **120** demodulates the DIF signal by 8-Vestigal Side Band (8-VSB). In another example, if the DIF signal output from the tuner **111** is a DVB signal, the demodulator **120** demodulates the DIF signal by Coded Orthogonal Frequency Division Multiple Access (COFDMA) demodulation.

Further, the demodulator **120** may perform a channel decoding. For the channel decoding, the demodulator **120** may include a Trellis decoder, a deinterleaver, and a Reed Solomon decoder, for Trellis decoding, deinterleaving and Reed Solomon decoding, respectively.

After the demodulation and channel decoding, the demodulator **120** may output a Transport Stream (TS) signal. A video signal, an audio signal, or a data signal may be multiplexed in the TS signal. For example, the TS signal may be a Moving Picture Experts Group-2 (MPEG-2) TS that includes a multiplexed MPEG-2 video signal and a Dolby AC-3 audio signal. Specifically, the MPEG-2 TS may include a 4-byte header and 184-byte payload. Thereafter the TS signal output from the demodulator **120** may be provided to the signal processor **140**. The signal processor **140** demultiplexes and processes the TS signal and outputs a video signal to the display **170** and an audio signal to the audio output portion **175**. An image display device having at least two tuners may have two demodulators. Preferably, a number of demodulators corresponds to a number of tuners, for example. Also, a demodulator may be separately provided for ATSC and DVB.

The signal input unit **110** may connect the image display device **100** to an external device. Here, the external device can be a digital versatile disc (DVD) player, a Blu-ray player, a game player, a camcorder, a computer (laptop computer), etc. The signal input unit **110** sends an external input video signal, an external input audio signal and an external input data signal to the signal processor **140** of the image display device **100**. The signal input unit **110** also outputs an audio, video or data signal processed in the image display device **100** to another external device.

In the signal input unit **110**, the A/V input module **112** may include a composite video banking sync (CVBS) port, a component port, an S-video port (analog), a Digital Visual Interface (DVI) port, a High Definition Multimedia Interface (HDMI) port, a Red, Green, Blue (RGB) port, a D-SUB port, an Institute of Electrical and Electronics Engineers (IEEE) 1394 port, a Sony/Phillips Digital InterFace (SPDIF) port, a Liquid HD port, etc. in order to provide audio and video signals received from the external device to the image display device **100**. Then, analog signals received through the CVBS port and the S-video port may be provided to the signal processor **140** after analog-to-digital conversion and digital signals received through the other input ports may be provided to the signal processor **140** without analog-to-digital conversion.

The USB input module **113** may receive audio and video signals through the USB port.

The RF signal input module **114** may connect the image display device **100** to a wireless network. The image display device **100** may access the wireless Internet or other network through the RF signal input module **114**. To connect to the wireless Internet, a communication standard, such as Wireless Local Area Network (WLAN) (Wi-Fi), Wireless Broadband (WiBro), Worldwide Interoperability for Microwave Access (Wimax), High Speed Downlink Packet Access (HS-

DPA), etc. may be used. Further, the RF signal input module **114** may conduct short-range communications with another electronic device. For example, the RF signal input module **114** may be networked to another electronic device by a communication standard like a Bluetooth, a Radio Frequency Identification (RFID), an InfraRed Data Association (IrDA), an Ultra Wideband (UWB), a ZigBee, etc.

The signal input unit **110** may connect the image display device **100** and a set-top box. For instance, if the set-top box is Internet Protocol (IP) TV capable, the signal input unit **110** may transmit an audio, video or data signal received from the IPTV set-top box to the signal processor **140** and a processed signal received from the signal processor **140** to the IP TV set-top box.

The term 'IPTV' as used herein covers a broad range of services, depending on transmission networks, such as Asynchronous Digital Subscriber Line-TV (ADSL-TV), Very high data rate Digital Subscriber Line-TV (VDSL-TV), Fiber To The Home-TV (FTTH-TV), TV over DSL, Video over DSL, TV over IP (TVIP), Broadband TV (BTV), and Internet TV and full-browsing TV which are capable of providing Internet access services.

The signal processor **140** may demultiplex a received TS signal including an MPEG-2 TS into an audio signal, a video signal and a data signal. The signal processor **140** may also process the demultiplexed video signal. For instance, if the demultiplexed video signal was coded, the signal processor **140** may decode the coded video signal. More specifically, if the demultiplexed video signal is an MPEG-2 coded video signal, an MPEG-2 decoder may decode the demultiplexed video signal. If the demultiplexed video signal was coded in compliance with H.264 for Digital Multimedia Broadcasting (DMB) or Digital Video Broadcasting-Handheld (DVB-H), an H.264 decoder may decode the demultiplexed video signal.

Also, the signal processor **140** may control brightness, a tint, and a color for the video signal. The video signal processed by the signal processor **140** is displayed on the display **170** (the signal processor **140** may also process the demultiplexed audio signal).

For example, if the demultiplexed audio signal was coded, the signal processor **140** may decode the audio signal. More specifically, if the demultiplexed audio signal is an MPEG-2 coded audio signal, an MPEG-2 decoder may decode the demultiplexed audio signal. If the demultiplexed audio signal was coded in compliance with MPEG 4 Bit Sliced Arithmetic Coding (BSAC) for terrestrial DMB, an MPEG 4 decoder may decode the demultiplexed audio signal. If the demultiplexed audio signal was coded in compliance with MPEG 2 Advanced Audio Codec (AAC) for satellite DMB or DVB-H, an AAC decoder may decode the demultiplexed audio signal. Further, the signal processor **140** may control a bass, a treble, and a volume of the audio signal. Thereafter, the audio signal processed by the signal processor **140** is provided to the audio output portion **175**.

Also, the signal processor **140** may process the demultiplexed data signal. For example, if the demultiplexed data signal was coded, the signal processor **140** may decode the data signal. The coded data signal may be Electronic Program Guide (EPG) information including broadcasting information such as the starts, ends, etc. of broadcast programs of each channel. For instance, the EPG information may be ATSC-Program and System Information Protocol (ATSC-PSIP) information in case of ATSC. In case of DVB, the EPG information may include DVB-Service Information (DVB-SI). The ATSC-PSIP information or DVB-SI may be included in the 4-byte header of the afore-described TS, i.e. MPEG-2 TS.

In addition, the signal processor **140** may perform an On-Screen Display (OSD) function. Specifically, the signal processor **140** may display graphic or text information on the display **170** based on at least one of the processed video and data signals and a user input signal received through a remote control device **200**.

Referring to FIG. **1**, the memory **160** may store programs for signal processing and control operations of the controller **180**, and store processed video, audio or data signals. Also, the memory **160** may temporarily store video, audio or data signals received through the signal input unit **110**. The memory **160** may include a storage medium of at least one type of flash memory, hard disk, multimedia card micro type, card-type memory (e.g. Secure Digital (SD) or eXtreme Digital (XD) memory), an optical disk, a removable storage such as a memory stick, Random Access Memory (RAM), and Read Only Memory (ROM) (e.g. Electrically Erasable Programmable ROM (EEPROM)). When a user selects a file to be reproduced, the image display device **100** may reproduce a file stored in the memory **160** (e.g. a moving image file, a still image file, a music file, a text file, etc.) and provide the file to the user.

The controller **180** provides overall control to the image display device **100**. The controller **180** may receive a signal from the remote control device **200** via the interface **150**. When the user inputs a command input to the remote controller **200**, the controller **180** identifies the command input using the received signal and controls the image display device **100** according to the command input. For example, upon receiving a predetermined channel selection command from the user, the controller **180** controls the tuner **111** to provide a selected channel through the signal input unit **110**, the signal processor **140** to process the audio and video signals for the selected channel, and the signal processor **140** to output user-selected channel information along with the processed audio and video signals to the display **170** or the audio output portion **175**.

Further, the user may enter a different-type video or audio output command through the remote control device **200**. For example, if the user wants to view an image from a camera or a camcorder received through the USB input module **113**, instead of a broadcast signal, the controller **180** may control the A/V processor **101** and the signal processor **140** to process an audio or video signal received through the USB input module **113** of the signal receiver **110**. Then, the controller **180** may output the processed audio and/or video signal to the display **170** and/or the audio output portion **175**.

In addition to commands received through the remote control device **200**, the controller **180** may also identify a user command received through the user input unit **155** provided to the image display device **100** and control the image display device **100** according to the user command. For example, the user may input other commands such as an on/off command, a channel switch command, a volume change command, or the like to the image display device **100** through the user input unit **155**. The user input unit **155** may include buttons or keys formed on the image display device **100** or may be a keyboard a touch screen, a key pad, a stylus, a mouse, etc. The controller **180** determines whether the user input unit **155** has been manipulated and controls the image display device **100** according to the determination result. The image display device **100** can be, e.g., a digital TV, a smart TV, a computer, a notebook, a portable multimedia device, a mobile terminal such as a smart phone, a navigation device, etc.

FIGS. **2**A to **2**C are perspective views of an example of an image display device **100** and a pointing device **201** is able to input a command to the image display device according to an embodiment of the present invention.

The pointing device **201** is an example of the remote control device **200** for entering a command for the image display device **100**. In accordance with the embodiment of the present invention, the pointing device **201** transmits and receives signals to and from the image display device **100** in compliance with an RF communication standard.

FIG. **2**A shows an example of the pointing device **201** according to an embodiment of the present invention. Referring to FIG. **2**A, the pointing device **201** according to the embodiment of the present invention may include various input keys, input buttons, etc. For example, the pointing device **201** may include an okay/enter/select key **291**, a menu key **292**, a 4-direction key **293**, a channel control key **294**, and a volume control key **296**.

For example, the okay/enter/select key **291** may be used to select a menu or item, the menu key **292** may be used to display a predetermined menu, the 4-direction key **294** may be used to move a pointer or indicator up, down, left and right, the channel control key **294** may be used to move a channel up or down, and the volume control key **296** may be used for volume control. The pointing device **201** may further include a back key **297** and a home key **298**. For example, the back key **297** may be used to move a screen to a previous screen and the home key **298** may be used to move a screen to a home screen.

As shown in FIG. **2**A, the okay/enter/select key **291** may further include a scroll function. For the scroll function, the okay/enter/select key **291** may be implemented as a wheel key. That is, by pushing the okay/enter/select key **291**, a menu or item is selected. When the okay key **291** is scrolled up or down, a display screen is scrolled or a list page is switched in accordance with the scrolled action of the okay/enter/select key **291**.

More specifically, for example, when an image having a size greater than the size of the display is displayed on the display **170**, the user may scroll the okay/enter/select key **291** to view and to display an image region of the image which is not currently displayed on the display. Further, a list page is displayed on the display **170**, the user may scroll the okay/enter/select key **291** to view and display a previous page or a next page of a current page. Such a scroll function may be included separately from the okay key **291**.

Referring to FIG. **2**A, four-direction key **293** may include up, down, left and right keys in a circular shape. Further, the four-direction key **293** may be configured to receive a touch input. For example, if a touch operation from the up key to the down key in the four-direction key **293** is performed, a predetermined function may be input or performed according to the touch input.

As shown in FIG. **2**B, a pointer **202** corresponding to another example of the pointing device **201** may be displayed on a screen of the display **170** of the image display device **100**. When the user moves the pointing device **201** up, down, left, right, forward or backward, or rotates it, the pointer **202** may be moved on the image display device **100** in correspondence with the movement of the pointing device **201**.

FIG. **2**C illustrates a movement of the pointer **202** on the screen of the image display device **100** according to a movement of the pointing device **201**. Referring to FIG. **2**C, when the user moves the pointing device **201** to the left, the pointer **202** also moves to the left on the image display device **100**. In accordance with the embodiment of the present invention, the pointing device **201** includes a sensor for sensing the movement of the pointing device **201**. Thus, information about the movement of the pointing device **201** sensed by the sensor is provided to the image display device **100**. Then, the image display device **100** determines the movement of the pointing device **201** based on the information about the movement of the pointing device **201** and calculates the coordinates of the pointer **202** corresponding to the movement of the pointing device **201**.

Here, the pointer **202** displayed on the display **170** moves in correspondence with an upward, downward, left or right movement or rotation of the pointing device **201**. The velocity or direction of the pointer **202** may correspond to that of the pointing device **201**. In accordance with the embodiment of the present invention, the pointer is set to move on the image display device **100** in correspondence with the movement of the pointing device **201**. It can be further contemplated as another embodiment of the present invention that a particular movement of the pointing device **201** triggers a predetermined command to the image display device **100**. For example, if the pointing device **201** moves forward or backward, an image displayed on the image display device **200** may be enlarged or contracted. Therefore, the embodiment of the present invention does not limit the scope of the present invention.

FIG. **3** is a block diagram of an example of the pointing device **201** and the interface **150** of the image display device **100** according to an exemplary embodiment of the present invention. The pointing device **201** is an example of the remote control device **200**.

Referring to FIG. **3**, the pointing device **201** may include a radio transceiver **220**, a user input portion **230**, a sensor portion **240**, an output portion **250**, a power supply **260**, a memory **270**, and a controller **280**, all operably coupled.

The radio transceiver **220** transmits and receives signals to and from the image display device **100**. In accordance with the embodiment of the present invention, the pointing device **201** may be provided with an RF module **221** for transmitting and receiving signals to and from the interface **150** of the image display device **100** according to an RF communication standard. Also, the pointing device **201** may include an IR module **223** for transmitting and receiving signals to and from the interface **150** of the image display device **100** according to an IR communication standard.

In accordance with the embodiment of the present invention, the pointing device **201** transmits signal carrying information about an operation of the pointing device **201** to the image display device **100** through the RF module **221**. Also, the pointing device **201** may receive a signal from the image display device **100** through the RF module **221**. Thus, the pointing device **201** may transmit commands associated with a power on/off, a channel switching, a volume change, etc. to the image display device **100** through the IF module **223**.

Also, the user input portion **230** may include a keypad or buttons. The user may enter a command to the pointing device **201** by manipulating the user input portion **230** to an operation to be performed on the image display device **100**. For example, if the user input portion **230** includes hard keys, the user may push the hard keys of the pointing device **201** for commands to be performed on the image display device **100**. Furthermore, if the user input portion **230** is provided with a touch screen, the user may touch soft keys on the touch screen of the pointing device **201** for commands to be performed on the image display device **100**. Also, the user input portion **230** may have a variety of input means which may be manipulated by the user, such as a scroll key, a jog key, etc., to which the present invention is not limited.

The sensor portion **240** may include at least one of a gyro sensor **241** and an acceleration sensor **243**. The gyro sensor **241** may sense an operation of the pointing device **201**. For example, the gyro sensor **241** may detect the directional information about an operation of the pointing device **201** along x, y and z axes. The acceleration sensor **243** may detect velocity information of the pointing device **201**.

In accordance with the embodiment of the present invention, in the sensor portion **240**, the gyro sensor **241** and the acceleration sensor **243** may be replaced with other sensors or other sensors may be included in addition to the gyro sensor **241** and the acceleration sensor **243**, in order to detect positional and moving data and information associated with the pointing device **201**. For example, the sensor portion **240** may include a geomagnetic sensor. In the geomagnetic sensor, three sensors for measuring strength of a magnetic field are provided along X, Y and Z axes, and the direction of the magnetic field influencing the sensors may be measured by a sum of output vectors of the three sensors. Therefore, the movement of the pointing device **201** can be sensed based on a change in a magnetic field.

Referring to FIG. **3**, the output portion **250** may output a video or audio signal corresponding to a manipulation of the user input portion **230** or a signal transmitted by the image display device **100**. The user may be aware from the output portion **250** whether the user input portion **230** has been manipulated or the image display device **100** has been controlled. For example, the output portion **250** may include a Light Emitting Diode (LED) module **251**. The output portion **250** is illuminated when the user input portion **230** has been manipulated or a signal is transmitted to or received from the image display device **100** through the radio transceiver **220**, a vibration module **253** for generating vibrations, an audio output module **255** for outputting audio, and/or a display module **257** for outputting video.

The power supply **260** supplies the power to the pointing device **201**. When the pointing device **201** is kept stationary for a predetermined time, the power supply **260** blocks the power from the pointing device **201**. When a predetermined key of the pointing device **201** is manipulated, the power supply **260** may resume a power supply.

The memory **270** may store a plurality of types of programs required for controlling or operating the pointing device **201**, or application data. When the pointing device **201** transmits and receives signals to and from the image display device **100** wirelessly through the RF module **221**, the pointing device **201** and the image display device **100** perform signal transmission and a signal reception in a predetermined frequency band. The controller **280** of the pointing device **201** may store information about the frequency band to wirelessly transmit and receive signals to and from the image display device **100** paired with the pointing device **201** in the memory **270**, and the controller **280** may refer to the information.

The controller **280** provides an overall control to the pointing device **201**. The controller **280** may transmit a signal corresponding to a predetermined key manipulation on the user input portion **230** or a signal corresponding to an operation of the pointing device **201** detected by the sensor portion **240** to the interface **150** of the image display device **100** through the radio transceiver **220**.

Here the interface **150** of the image display device **100** may include a radio transceiver **151** for wirelessly transmitting and receiving signals to and from the pointing device **201**, and a coordinate calculator **154** for calculating the coordinates of the pointer corresponding to an operation of the pointing device **201**. Further, the interface **150** may transmit and receive signals wirelessly to and from the pointing device **201** through the RF module **152**. The interface **150** may also receive a signal from the pointing device **201** through the IR module **153** based on the IR communication standard.

The coordinate calculator **154** may calculate the coordinates (x, y) of the pointer **202** to be displayed on the display **170** by correcting a handshaking or errors from a signal corresponding to an operation of the pointing device **201** received through the radio transceiver **151**.

Thereafter, a signal received from the pointing device **201** through the interface **150** is provided to the controller **180** of the image display device **100**. The controller **180** may identify information about an operation of the pointing device **201** or a key manipulation on the pointing device **201** from the signal received from the pointing device **201** and control the image display device **100** according to the identical information.

In another example, the pointing device **201** may calculate the coordinates of the pointer corresponding to the operation of the pointing device and output the coordinates to the interface **150** of the image display device **100**. The interface **150** of the image display device **100** may then transmit the received coordinate information to the controller **180** without correcting a handshaking or errors.

FIGS. **1**, **2A-2C** and **3** illustrate the image display device **100** and the pointing device **201** as the remote control device **200** according to an embodiment of the present invention. The components of the image display device **100** and the pointing device **201** may be integrated or omitted, or a new component may be added. That is, when needed, two or more components may be incorporated into a single component or one component may be configured to be divided into two or more separate components. Also, the function of each block is presented for illustrative purposes, not limiting the scope of the present invention.

FIG. **4** is a flow chart illustrating a method for operating an image display device according to an embodiment of the present invention. The method of FIG. **4** can be implemented by the device of FIGS. **1-3** or by other suitable devices.

As shown in FIG. **4**, at least one of objects including a broadcast image and a menu icon is displayed on the display **170** and a wireless communication unit (e.g., radio transceiver **151**) receives a pointing signal from the pointing device **201** (S**400**). The pointing signal includes values output from the gyro sensor **241** and/or the acceleration sensor **243** included in the pointing device **201**. When the pointing device **201** is in an active state, a pointing signal is continuously transmitted from the pointing device **201** to the wireless communication unit.

Then, the controller **180** calculates x and y coordinates on the display **170** using the pointing signal received in step S**400** (S**405**). The controller **180** displays a pointer on the display **170** according to the calculated coordinates (x, y) (S**410**). The pointer **202** may be displayed not only as an arrow but also as a cursor or finger image and may be displayed so as to opaquely overlap the menu icon or broadcast image on the display **170**.

The controller **180** then determines whether or not a selection signal has been transmitted from the pointing device **201** (S**415**). The selection signal is a signal that is transmitted from the pointing device **201** to the wireless communication unit when a user command is input through the user input portion **230**. The selection signal includes information regarding a command to execute one or more of various operations on the image display device **100**. While the selection signal is transmitted, a pointing signal is continuously transmitted from the pointing device **201**.

When the selection signal is transmitted from the pointing device **201**, the user input unit **155** calculates coordinates of

the pointer using a pointing signal that has been input for a predetermined interval prior to a time point at which the selection signal is transmitted and the controller **180** displays the pointer **202** on the display **170** based on the pointing signal input within the predetermined interval (S**420**). For example, if the predetermined time interval is 400 ms and the selection signal was received at a time T, then the controller **180** calculates coordinates where the pointer was located during T−400 ms and T. Thereafter, the controller **180** determines whether the selected operation is what the user intended to select by comparing the calculated coordinates of the pointer within the predetermined time interval. The predetermined interval may include an interval in which a pointing signal corresponding to the same coordinates is input for a predetermined time or longer. The predetermined interval will hereinafter be referred to as an "input standby time" for the selection signal. The input standby time may be 400 ms (i.e., 0.4 s) prior to the time point at which the selection signal is transmitted.

On the other hand, the coordinate calculator **154** may store information regarding a pointing signal input during the input standby time. That is, since it is difficult to predict when the selection signal will be transmitted again, the coordinate calculator **154** stores information of a position signal input simultaneously with the input standby time. Thus, when another selection signal is transmitted later, the coordinate calculator **154** can immediately calculate coordinates using the information regarding the pointing signal stored in real time.

Thereafter, the controller **180** performs an operation based on the calculated coordinates of the pointer to determine a region where the pointer was displayed for the most time during the input standby time (S**425**). That is, the controller **180** calculates coordinates for a pointing signal input during the input standby time where the pointer was displayed, thereby determining that the selectable region where the selection signal was received is the region that the user in fact selected to perform an operation corresponding to the selection signal. Thus, once the selection signal is received, the controller **180** calculates the coordinates of the pointer during the input standby time and determines that the coordinates of the pointer were at the particular selectable region for most of the time during the input standby time. Then, the controller **180** executes an operation associated with the particular selectable region where the pointer was displayed for the most of the time during the input standby time. This particular selectable region will also be referred herein as the "most frequently displayed region."

For example, when a selection signal is input from the pointing device, the controller **180** may execute a menu object displayed at a position corresponding to the most frequently displayed region.

The method according to an embodiment of the present invention may further include selecting an object displayed in a region in which the pointer has been most frequently displayed. Here, a display state of the selected object such as color and size may be different from another object.

Here, a region in which the pointer is displayed may be an inside region of an object. In this case, the controller **180** may perform an operation corresponding to the object.

It is possible that although the user intended to execute one operation, due to an unwanted hand shaking of the user, the user may select a selectable object associated with another operation. By calculating the most frequently displayed region, the image display device may correctly select the operation that the user actually intended to execute. Therefore, it is possible to correct an unwanted selection of an operation due to a hand shaking by performing an operation corresponding to coordinates of the most frequently displayed region calculated during the predetermined interval. Accordingly, the controller **180** may perform a menu item displayed at a position corresponding to coordinates of the most frequently displayed region calculated on the display **170** and may display an image at a position corresponding to the calculated coordinates of the most frequently displayed region.

For example, when a selection signal has been input, a menu icon displayed on the display **170** at a position corresponding to the calculated coordinates of the most frequently displayed region in step S**420** may be selected and a submenu of the selected menu icon may be displayed or a menu item corresponding to the selected menu icon may be executed.

The image displayed at the position corresponding to the most frequently displayed region may include any image that is distinguished from images displayed on the display **170** before the selection signal is input and may be expressed as a dot, a line, or a surface. For example, in the case where selection signals are continuously input, dot images may be continuously displayed on the display **170** and a character (or a letter) may be displayed using the continuously displayed dots on the display **170** of the image display device **100**.

FIG. **5** illustrates a method for operating an image display device according to an embodiment of the present invention together with a screen displayed on a display **170**.

As shown in FIG. **5**(*a*), a broadcast image **505** and an object **510** including A, B, C, and D icons are displayed on a display region on the display **170**. A pointer **500** is displayed in the display region according to coordinates calculated from a pointing signal. Since the pointer **500** is displayed so as to opaquely overlap the object **510** to allow the user to correctly identify the position of the pointer **500**. In order to execute a menu item corresponding to the B icon, for example, the user controls the pointing device **201** such that the pointer **500** is displayed in a region in which the B icon is displayed and generates a selection signal using the user input portion **230** of the pointing device **201**.

When the object **510** and the pointer **500** are enlarged and displayed on the display **170**, an A icon **511**, a B icon **512**, a C icon **513**, and a D icon **514** are displayed adjacent to each other with boundaries therebetween as shown in FIG. **5**(*b*). The user pushes the user input portion **230** of the pointing device **201** after controlling the pointing device **201** such that the pointer **500** is displayed in a region in which the B icon is displayed. In this case, due to a momentary hand shaking of the user, the pointing device may be controlled to change the pointing signal to the C icon **513**. Thus, the user input portion **230** of the pointing device **201** may transmit a selection signal selecting the C icon **513** at a location of a pointer **500**C due to hand shaking of the user even when the user actually intended to select the B icon **512**. That is, a menu item corresponding to the C icon rather than a menu item corresponding to the B icon may be executed due to the user's hand shaking. However, in this case, if the controller **180** determines that the most frequently displayed region during the input standby time is on a location of the B icon **512**, the controller **180** may execute the B icon **512** instead of the C icon **513**. This will be explained in connection with FIG. **6**.

FIG. **6** illustrates change of a pointing signal according to an embodiment of the present invention.

As shown in FIG. **6**, the vertical axis represents the degree of the hand shaking for a user holding the remote control device **200** and the horizontal axis represents time. With reference to FIGS. **5** and **6**, while a pointing signal corresponding to coordinates at which the B icon is displayed is

continuously input, the pointing signal may be changed due to a temporary hand shaking as a selection signal is transmitted. Then, a pointing signal corresponding to coordinates at which the C icon is displayed is input. Therefore, to correct this error, the controller **180** calculates the most frequently displayed region during the input standby time. If the controller **180** determines that the most frequently displayed region is the location of the B icon **512**, for example, although the selected region is a location of the C icon **513**, an operation associated with the B icon **512** may be executed. The input standby time may be a duration of 0.4 seconds prior to the time point at which a selection signal is input. That is, it is possible to differentiate a user selection based on a temporary handshaking from an actual intended selection by the user.

FIG. **7** illustrates a method for operating an image display device according to an embodiment of the present invention.

A display **600** is illustrated. The display **600** may be an example of the display **170** of the image display device **100**. Referring to FIG. **7**, a pointer **605** is displayed in a first object on the display **600**. For example, as shown in FIG. **7**(*a*), a plurality of objects **610**, **620**, **630**, and **640** may be displayed on the display **600** and a pointer **605** may be displayed in the first object **610**.

The pointer **605** is an indicator that is displayed on the display **600** according to a pointing signal received from the remote control device **200**. Although an arrow is displayed as an example of the pointer **605** in FIG. **7**, the pointer may be displayed as a cursor or finger image without being limited to the arrow. The pointer **605** may be displayed on the display **600** so as to opaquely overlap the objects **610**, **620**, **630**, and **640** displayed on the display **600**.

Although various embodiments of the remote control device **200** are possible, the following description will be given with reference to the case where the remote control device **200** is a pointing device **201** as described above.

The controller **180** then determines whether or not a movement signal has been input. The movement signal may include information regarding pointer coordinates calculated through the interface **150** or the like as described above. By receiving the coordinate information in real time, the controller **180** can determine whether or not a movement signal has been input from the pointing device **201**.

Upon receiving the movement signal from the pointing device **201**, the controller **180** displays the pointer **605** on the display **600** such that the pointer **605** moves according to the movement signal. That is, the controller **180** controls the pointer **605** to be displayed such that the pointer **605** moves on the display **600** according to the movement signal.

For example, as shown in FIG. **7**(*b*), the controller **180** displays the pointer **605** moving to the right side on the display **600** when a right movement signal is input from the pointing device **201** while the moving pointer **605** is displayed within the first object **610** on the display **600**.

The controller **180** then determines whether or not the pointer **605** is moved to the outside the object **610**. Then, the controller **180** compares boundary coordinates of the first object **610** with coordinates to which the pointer **605** has moved and determines whether or not the moved coordinates of the pointer **605** have exited the boundary coordinates of the first object **610**.

When the pointer **605** is displayed outside the first object **610**, the controller **180** automatically moves the pointer **605** to the inside of the second object **620** adjacent to the first object **610**. That is, once the pointer **605** have exited the first object **610**, the controller **180** automatically moves the pointer **605** to the inside of the second object **620** adjacent to the first object **610** rather than displaying the pointer **605** at the moved coordinates.

For example, as shown in FIG. **7**(*c*), as soon as the pointer **605** moves out of the first object **610** on the display **600**, the pointer **605** is automatically and instantaneously moved to the inside of the second object **620** immediately adjacent to the first object **610**. Here, the second object **620** may be located next to the first object in the direction to which the pointer **605** is moving. Although the pointer **605** is automatically moved and displayed inside of the second object **620** adjacent to the first object **610** at the right side thereof according to the right movement signal in the illustrated example, the present invention is not limited to this example and various other embodiments are possible. For example, the pointer **605** may be automatically moved to the inside of another object that is located closest to the first object **610** or an object that is located closest to the first object **610** in the direction the pointer **605** is moving. According to this scheme, the second object **620** is also selected in the illustrated example.

Examples of the object may include a menu and a widget as described above. For example, the object may be a selectable menu item. The controller **180** may identify the object by analyzing an image signal displayed on the display **600**.

The automatic moving of the pointer in the above manner allows the user to easily move the pointer to the inside of an adjacent object. This provides an increased convenience for the user and there is no need to perform a high-precision hand shaking correction.

FIGS. **8** and **9** illustrate a method for operating an image display device according to an embodiment of the present invention.

As shown in FIGS. **8** and **9**, first, a pointer **705** is displayed outside a plurality of objects on a display **700**. The display **700** may be an example of the display **170**. For example, as shown in FIG. **8**(*a*), the pointer **705** may be displayed outside a plurality of objects **710**, **720**, **730**, and **740** on the display **700**. In an example of FIG. **8**(*a*), the pointer **705** is displayed at the left side of the first object **710**.

The pointer **705** is an indicator that is displayed on the display **700** according to a pointing signal received from the remote control device **200**. Although an arrow is displayed as an example of the pointer **705** in FIG. **8**, the pointer may be displayed as a cursor or finger image without being limited to the arrow. The pointer **705** may be displayed on the display **700** so as to opaquely overlap the objects **710**, **720**, **730**, and **740** displayed on the display **700**.

Although various embodiments of the remote control device **200** are possible, the following description will be given with reference to the case where the remote control device **200** is a pointing device **201** as described above.

The controller **180** then determines whether or not a movement signal has been received from the pointing device **201**. The movement signal may include information regarding pointer coordinates calculated through the interface **150** or the like as described above. By receiving coordinate information in real time, the controller **180** can determine whether or not a movement signal has been input from the pointing device **201**.

Upon receiving a movement signal from the pointing device **201**, the controller **180** moves the pointer **705** on the display **700** according to the movement signal. That is, the controller **180** controls the pointer **705** to be displayed such that the pointer **705** moves according to the movement signal. For example, as shown in FIG. **8**(*b*), the controller **180** displays the pointer **705** such that the pointer **705** moves to the right side on the display **700** when a right movement signal is

input from the pointing device **201** with the pointer **705** being displayed at the left side of the first object **710** on the display **700**.

The controller **180** then determines whether or not the pointer **705** has approached the first object **710** within a predetermined range. The controller **180** compares boundary coordinates of the first object **710** with coordinates to which the pointer **705** has moved and determines whether or not the moved coordinates of the pointer **705** have reached the predetermined range **715** of the boundary coordinates of the first object **710**. The predetermined range **715** may be a predetermined boundary region around the first object **710**. Although the boundary region has uniform vertical and horizontal widths around the first object **710** in the example of FIG. **8**, the boundary region may be set variously without being limited to the example.

When the pointer **705** has approached the first object **710** within the predetermined range **715**, the controller **180** automatically moves and displays the pointer **705** inside of the first object **710**. For instance, when the moved coordinates of the pointer **705** have reached or entered the boundary coordinates the predetermined range **715** of the first object **710**, the controller **180** displays the pointer **705** such that the pointer **705** automatically moves to the inside of the first object **710** rather than displaying the pointer **705** at the moved coordinates. For example, as shown in FIG. **8**(*c*), as soon as the pointer **705** enters the predetermined range **715** of the first object **710** on the display **700**, the pointer **705** is automatically and instantaneously moved to the inside of the first object **710**.

Although the pointer **705** is displayed such that the pointer **705** automatically moves to a right direction according to a right move command in the FIG. **8**(*c*), the present invention is not limited to the specific embodiment.

For example, as shown in FIG. **9**, the pointer **705** displayed under a portion of the first object **710** moves to an up direction according to an up move command, as soon as the pointer **705** enters the predetermined range **715** of the first object **710** on the display **700**, the pointer **705** is displayed such that the pointer **705** automatically moves to the inside of the first object **710**. For example, when the pointer **705** is moved to P**1**, the pointer **705** is automatically moved to P**2**. On the other hand, when the pointer **705** approaches P**3**, the pointer **705** is automatically moved to P**4**.

Although a plurality of objects is displayed such that predetermined ranges of the objects do not overlap each other in the illustrated example, the predetermined ranges of the objects may overlap each other. In this case, it is preferable that the pointer **705** automatically move to the first accessible one (for example, a closest one) of the objects.

In the case where a plurality of objects is displayed at the same distances from each other while predetermined ranges of the objects overlap each other, it is preferable that the pointer **705** be displayed such that the pointer **705** moves to the inside of an object having the largest area among the objects since the user may be likely to select the object having the largest area.

Examples of the object may include a menu and a widget as described above. For example, the object may be a selectable menu item. The controller **180** may identify the object by analyzing an image signal displayed on the display **700**.

An automatic moving of the pointer in the above manner of the invention allows the user to easily move the pointer to the inside of an adjacent object. This has advantages in that user convenience is increased and there is no need to perform high-precision hand shaking correction.

As is apparent from the above description, according to the present invention, it is possible to correctly perform an operation intended by the user when the image display device is controlled using the pointing device.

The embodiments of the present invention can be embodied as a processor readable code stored in a processor readable medium provided in an image display device. The processor readable medium includes any type of storage device that stores data which can be read by a processor. Examples of the processor readable medium include a Read Only Memory (ROM), a Random Access Memory (RAM), CD-ROMs, magnetic tapes, floppy disks, optical data storage devices, and so on. The processor readable medium can also be embodied in the form of carrier waves such as signals transmitted over the Internet. The processor readable medium can also be distributed over a network of coupled processor systems so that the processor readable code is stored and executed in a distributed fashion.

Although the embodiments of the present invention have been illustrated and described above with reference to the specific embodiments, the present invention is not limited to the specific embodiments and it will be apparent to those skilled in the art that various modifications can be made to the embodiments without departing from the scope of the present invention as disclosed in the accompanying claims and such modifications should not be construed as departing from the spirit or scope of the present invention.

What is claimed is:

1. A method for operating an image display device including a controller, the method comprising:

displaying a pointer outside a plurality of objects displayed on a display of the image display device;

receiving, from a remote control device, a movement signal to move the pointer on the display, the movement signal including information regarding a location of the pointer;

moving the pointer on the display according to the movement signal; and

automatically moving, by the controller, the pointer inside a particular object among the plurality of objects when the pointer has approached the particular object according to the movement signal,

wherein the automatically moving the pointer onto the particular object further comprises:

determining whether the pointer approached a predetermined boundary region around the particular object;

automatically moving the pointer inside the particular object when the pointer approached a predetermined boundary region; and

automatically moving the pointer to one of a first and a second object based on a predetermined condition when the pointer has approached a location. on the display, a first predetermined outer area of the first object. and a second predetermined outer area of the second object overlapping each other and distances from the location to the first and second predetermined area being substantially the same,

wherein the predetermined condition includes a size, a frequent usage, or a recent usage of the object.

2. The method according to claim **1**, wherein the particular object is a selectable object.

3. The method according to claim **1**, wherein the predetermined condition is the size of the object.

4. The method according to claim **1**, wherein the remote control device is a pointing device.

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